Size Variation Survey of The Family of Cichlids in Lower River Benue

ABSTRACT:

This study was designed to determine the size variations of the family of Cichlids in lower river Benue. The fish samples were collected bimonthly in batches for a period of three months (September, October and November). A total of 120 fishes comprising 60 each of *Tilapiazilli* and *Oreochromis niloticus*were sampled from fishermen at the Wadata landing site during this period. The fish sampled were transported in an ice-parked plastic container to the Fisheries laboratory. The species were identified using taxonomic keys and morphometric parameters recorded. The results obtained shows the parameters of *Oreochromis niloticus* and *Tilapia zilli* as the cichlids species caught. The mean weight (53.70±3.13), mean length (14.09±0.28) and the mean standard length (11.13±0.24) of *Tilapia Zilli* was observed to be greater than the mean weight (43.01±2.17), mean length (12.83±2.0.21) and mean standard length (10.17±0.81) of *Oreochromis niloticus*. The results obtained reveals that the morphometry of ***Tillapiazilli*** is higher in their Morphometric measurements as compared to ***Oreochromis niloticus.*** This study therefore provides valuable information on the morphological characteristics in relation to the body weight of these two Cichlids for the sustainable management of fisheries in Lower River Benue, Makurdi and Nigeria at large.

Keywords: Size Variation, Cichlids, River Benue, Total Length, Standard Length

1.0 INTRODUCTION

Cichlids are fishes from the family Cichlidae in the order Perciformes. Cichlids fishes are the most species rich family of all teleost fishes, and their diversity is centered in the Great African Lakes with more than 2000 species (Turner *et al.* 2001). Cichlids are particularly well known for having evolved rapidly into a large number of closely related but morphologically diverse species within large lakes (Meyer 2005). It is estimated that Africa alone hosts at least 1,600 species (Nelson 2006). Cichlids are highly abundant and commercially important fish in natural and man-made lakes in Nigeria.

The study of size variation within species is very important in biology. It is of high relevance in population studies as it is useful in distinguishing species taxonomically and establishing evolutionary relationships (Deesri*et al*., 2009). Size variation provides important clues about the taxonomy, morphology, behavior, and life history of species. The study of differences and variability in size of fish stocks is important in phylogenetics and providing information for subsequent studies on the genetic improvement of stocks. Size variation of a population is in turn affected by multiple factors including environmental conditions, changes in stock size, ecological interactions and anthropogenic disturbances, such as fishing pressure that influences individual growth and size-dependent mortality (Swain *et al*., 2007). In many cases, body size measurements are the unique source of demographic information from a fishery. Morphological description (morphometrics) is a vigorous tool for measuring discreteness of the same species (Cadrin, 2000).

Morphometrics is the quantitative analysis of form; both size and shape. Morphometric characters can show high plasticity in response to differences in environmental conditions such as food (benthic-pelagic feeding niche continuum), presence of predators, water velocity, salinity and temperature (Kristjánsson, 2002). Also selection pressures operating within different habitats or habitat units favor specific traits more than the others as traits that are well suited to the conditions found in one habitat may be ill-suited to those found in others (Webster *et al.*, 2011).

Environmental changes in the habitats of the fish due to human activities and continuous constructions along coastal lines as well as the pollution of the aquatic environment by fertilizers and pesticides, are expected to cause some morphological changes within species. Both morphometric and meristic characters respond to changes in environmental factors and these responses differ from species to species. Mwanja*et al.*, (2011) stated that morphological change and divergence within species are expected to take place when fishes are exposed to new developmental and evolutionary forces that determine their body forms. A change could take place, either through natural hybridization or the effect of the environmental factors that operate in early stages of development (Mohamed, 2010).

Different studies has been conducted on size variation of fishes within populations of the same species in the Nigerian territorial waters, some of these works includes those of Omoniyi and Agbon, 2008; Solomon *et al.*,

2015; Oladimeji *et al*., 2015; Ukenye*et al.*, 2015 amongst others. However, there is paucity of information on the size variation of Cichlids in Lower River Benue. This study therefore aims at determining the size variation of the family cichlids in lower River Benue by using morphometric characters. The study also attempts to characterize the populations of these fishes in this River and determine the morphometric characteristics that contribute mostly to the variation of the cichlids in lower River Benue.

2.0 Materials and Methods

2.1 Description of Study Area

The study was carried out in the Lower Benue River at Makurdi, Nigeria. Benue River originates in the Adamawa Mountains of the central Cameroun and flows westward for 1,400km until it meets the Niger River about, 450km above the delta, near the city of Lokoja, Nigeria (Ashley, 2010). The upper reaches of River Benue forms narrow valleys and contain falls and rapids. Most of the lower portions however are free from rapids and have extensive floodplains (1,800km^2) and braided with stream channels of different sizes which meander across the floodplain. The floodplain also contains seasonally inundated depressions known as fadamas. These provide importance fishery resources, which are exploited after the flood has receded (Sarch, *et. al*.,2001). The average annual rainfall is between 1000 and 1500mm. These seasonal differentials markedly affect the rivers physico-chemistry, fauna composition and abundance. In the rainy season, the river overflows the banks and inundates the grassy riparian zones. Additionally, there is a wash down of a high load of allochthonous inputs from domestic and farm areas. In the dry season however, the water level recedes considerably leaving a silted river bed with clear shallow water.

2.2 Sample Collection and Method

The fish samples were collected bimonthly in batches for a period of three months (September, October and November). A total of 120 fishes comprising 60 each of *Tilapiazilli* and *Oreochromis niloticus*were sampled from the fishermen at Wadata landing site during this period. The fish samples were transported in an ice-parked plastic container in order to keep them fresh immediately before taken to the laboratory. In the laboratory, the fish samples were sorted out and identified to specie level using identification keys.

2.3 Morphometric measurements

The measurable morphometric characters that were taken include standard length (SL), Body weight (BW), Total Body Length (TBL), Dorsal Fin Length (DFL) Caudal Fin Length (CFL) Head Length (HL), Body width (BW) Anal fin length (AFL) Pectoral fin length (PFL) and Pelvic fin length (PFL). Standard Length (SL) was taken along the body axis. The body weight (BW) was measured using a weighing balance and recorded in grams (g). The total body length (TL), was taken along the anterior posterior body axis from mouth tip to the end of the caudal fin. The dorsal fin length was taken from the start of the fin to the end by the dorsal side. The caudal fin length was taken from the caudal region to the end of the fin. The head length was taken from the snout of the mouth to the beginning of the operculum. The anal fin length was taken from the anal region to end of the fin. The pectoral fin length was taken from the pectoral region to the end. The pelvic fin length was taken from the pelvic region to the end while the body width was taken from the head region to the end of the caudal fin. All length measurement was recorded in centimeter (cm) and was taken using measuring meters.

2.4 Data Analysis

The results obtained from the study was subjected to descriptive statistics using SPPS version 21. Similarly, correlation analysis between the parameters was determined using SPPS Version 21. The results for the body weight and standard length was transformed to log of base 10 to normalized them and stabilize the variance.

3.0 Results

3.1 Weight Variation in the Family Cichlidae from Lower River Benue

The summary of weight variation in the family cichlidae in (Table 1) shows that mean weight was highest among *Tilapia zilli* with a mean of 53.70g and a range of 25.20g to 105.60g. The mean weight of *Oreochromis niloticus* was 43.01g and range from 108.60g to 13.60g.

TABLE 1: Weight Variations in the Family Cichlidae

Species	Mean Weight (g)	Maximum weight (g)	Minimum weight (g)
Oreochromis niloticus	**43.01±2.17[b]**	**108.60**	**13.60**
Tilapia zilli	**53.70±3.13[a]**	**105.60**	**25.20**
P-Value	**0.01**	**0.01**	**0.01**

**Means in the same row with different superscripts differ significantly*

3.2 Length Variation in the Family Cichlidae from Lower River Benue

The summary of Total length variation in the family cichlidae in (Table 2) shows that mean length was highest among *Tilapia zilli* with a mean of 14.09cm and a range of 10.50cm to 19.00cm. The mean length of *Oreochromis niloticus* was 12.83cm and range from 9.10cm to 18.00cm.

TABLE 2: Total Length Variations in the Family Cichlidae

Species	Mean length (cm)	Maximum length (cm)	Minimum length (cm)
Oreochromis niloticus	**12.83±0.21[b]**	**18.00**	**9.10**
Tilapia zilli	**14.09±0.28[a]**	**19.00**	**10.50**
P-Value	**0.00**	**0.00**	**0.00**

**Means in the same row with different superscripts differ significantly*

3.3 Standard Length Variation in the Family Cichlidae from Lower River Benue

The summary of standard length variation in the family cichlidae in (Table 3) shows that mean standard length was highest among *Tilapia zilli* with a mean of 11.13cm and a range of 8.30cm to 15.20cm. The mean standard length of *Oreochromis niloticus* was 10.17cm and range from 6.00cm to 14.10cm.

TABLE 3: Standard Length Variations in the Family Cichlidae

Species	Mean Stand. Length (cm)	Maximum Stand. Length (cm)	Minimum Stand. Length (cm)
Oreochromis niloticus	**10.17±0.18[b]**	**14.10**	**6.00**
Tilapia zilli	**11.13±0.24[a]**	**15.20**	**8.30**
P-Value	**0.00**	**0.00**	**0.00**

**Means in the same row with different superscripts differ significantly*

3.4 Morphometric Variation in the Family Cichlidae from Lower River Benue

Selected morphometric characteristics of the family cichlidaea are presented in the table 4 below. Dorsal fin length (8.43±0.22), head length (3.84±0.08), pelvic fin length (4.10±0.10) and anal fin length (3.82±0.11) of *Tilapia Zilli* were higher than the dorsal fin length (7.39±0.16), head length (3.51±0.06), pelvic fin length (3.29±0.08) and anal fin length (3.54±0.07) of *Oreochromis niloticus*. However, the pectoral fin length (3.31±0.07)

and condition factor (1.99±0.07) were higher for *Oreochromis niloticus* compared to *Tilapia Zilli* with pectoral fin length of (3.20±0.09) and condition factor of (1.86±0.03), respectively. Significant differences can be observed in majority of the parameters (dorsal fin length, head length, pelvic fin length and anal fin length).

TABLE 4: Some Morphometric Variation in The Family Cichlidae from Lower River Benue

Body Parameters	*Oreochromis niloticus*	*Tilapia zilli*	P-Value
Dorsal Fin Length (cm)	7.39±0.16[b]	8.43±0.22[a]	0.00
Caudal Fin Length (cm)	2.76±0.12[a]	2.83±0.06[a]	0.74
Head Length (cm)	3.51±0.06[b]	3.84±0.08[a]	0.00
Pelvic Fin Length (cm)	3.29±0.08[b]	4.10±0.10[a]	0.00
Pectoral Fin Length (cm)	3.31±0.07[a]	3.20±0.09[a]	0.36
Anal Fin Length (cm)	3.54±0.07[b]	3.82±0.11[a]	0.04
K	1.99±0.07[a]	1.86±0.03[a]	0.22

**Means in the same row with different superscripts differ significantly*

3.5 Correlations between size variables and some morphometric parameters in the family cichlidae

The correlation of the size variables and the morphometric parameters of the family cichlidae are shown in the table 5 below. Significant relationships can be observed in all the parameters except between total weight and the condition factor. All the correlations were observed to be positive.

TABLE 5: Correlations Between Size Variables and Some Morphometric Parameters in The Family Cichlidaefrom Lower River Benue

Body Parameters	Total Weight	Total Length	Standard Length
Dorsal Fin Length	0.791*	0.912*	0.912*
Caudal Fin Length	0.274*	0.338*	0.342*
Head Length	0.674*	0.857*	0.845*

Pelvic Fin Length	0.642*	0.795*	0.778*
Pectoral Fin Length	0.600*	0.704*	0.698*
Anal Fin Length	0.746*	0.899*	0.869*
K	0.165	-0.330*	-0.306*

Means in the same row with different superscripts differ significantly

4.0 DISCUSSION, CONCLUSION AND RECOMMENDATION

4.1 Discussion

The morphometry was, total body weight, total length, standard length, dorsal fin length, caudal fin length, head length, pelvic fin length, pectoral fin length and anal fin length. All these measurements were different in these two species except for caudal fin length. For *Tilapia Zilli*, the mean values of the morphometric measurements were higher than that of the *Oreochromis niloticus*except for pectoral fin length and condition factor. This results agrees with the findings of Fagbuaro *et al.*, (2016) who earlier reported that the morphometry of*Tillapiazilli* has been higher in their measurements as compared to the *Oreochromis niloticus.* The reason for the wide variation in size of these two species may be due to the differences in the environmental variables in the study locations where the fish samples were caught, biotic and abiotic factors, genetics and their interactions are believed to be the main cause of the observed morphometric variations which may be impacting negatively on the fish species.

Within Nigeria, Fagbuaro (2015) successfully delineated three clades of *Tilapia Zilli* within three Dams in South-Western Nigeria using differences observed in head length, total length, standard length, pre-pelvic distance and body weight, which he reported higher Morphometry values of *Tilapia Zilli* from the dams which were different from the present study. Similarly, differences in standard length, pre-anal fin length, body depth, peduncle depth and pre-pelvic fin length have been reported for Guinean tilapia (*Coptodonguinensis*) in two locations within the Niger Delta region of Nigeria (Olopade,2018). The present study shows a Significant relationships for all the parameters except between total weight and the condition factor in both species. All the correlations were observed to be positive. This result shows clearly that the growth of *Oreochromis niloticus* and *Tilapia Zilli* in lower Benue River is proportional to the body of the fish. This may be attributed to the hidden factors that are militating against the growth response pattern of the fish in lower Benue River at Makurdi. The variation in the morphological parameters recorded within the same species of Tilapia may be due to the genetic makeup and at the same time linked to the environment which has a fundamental role in the expression of the genes. This study provides valuable insight on the Morphometry in relation to the body weight of two Cichlids for the sustainable management of fisheries in Makurdi and Nigeria at large.

4.2 Conclusion

From the results obtained, it can be concluded that the morphometry of ***Tillapiazilli*** is higher in their Morphometric measurements as compared to ***Oreochromis niloticus***whichprovides valuable information on the morphological characteristics in relation to the body weight of two Cichlidae for the sustainable management of fisheries in Makurdi and Nigeria at large.

4.3 Recommendations

Based on the results of this study, the following recommendations are made:

1. Further studies could determine size variations in cichlids for other period not covered by this study.
2. Effective and sustainable management of these two species should be ensured in this water body to avoid over exploitation.

5.0 References

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